Most industries that purchase boilers are sensitive to economic conditions. Therefore, during economic downturns, construction boilermakers may be laid off. However, because maintenance and repairs of boilers must continue even during economic downturns, boilermaker mechanics generally have stable employment.

Earnings

In 1998, the median hourly earnings of boilermakers were about $18.45. The middle 50 percent earned between $15.04 and $22.49. The lowest 10 percent earned less than $11.40 and the highest 10 percent earned more than $25.53.

Apprentices generally start at about 60 percent of journey wages, with wages gradually increasing to the journey wage as progress is made in the apprenticeship. However, wages vary greatly around the country, with higher wages in Northeastern, Great Lakes, and Far Western states than in other areas of the country.

Almost one-half of all boilermakers belong to labor unions. The principal union is the International Brotherhood of Boilermakers. Other boilermakers are members of the International Association of Machinists, the United Automobile Workers, or the United Steelworkers of America.

Related Occupations

Workers in a number of other occupations assemble, install, or repair metal equipment or machines. These occupations include assemblers, blacksmiths, instrument makers, ironworkers, machinists, millwrights, patternmakers, plumbers, sheet-metal workers, tool and die makers, and welders.

Sources of Additional Information

For further information regarding boilermaking apprenticeships or other training opportunities, contact local offices of the unions previously mentioned, local construction companies and boiler manufacturers, or the local office of your State employment service.

For information on apprenticeships and the boilermaking occupation, contact:

☛ American Boiler Manufacturing Association, 950 North Glebe Rd., Suite 160, Arlington, VA 22203-1824.

☛ International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 753 State Avenue, Suite 570, Kansas City, KS 66101.

Bricklayers and Stonemasons

(O*NET 87302 and 87305B)

Significant Points

- Opportunities should be excellent because job openings are expected to grow faster than the number of workers being trained.
- Work is usually outdoors, requires lifting heavy bricks and blocks, and sometimes involves working on scaffolds.
- Nearly 3 out of every 10 bricklayers and stonemasons are self-employed.

Nature of the Work

Bricklayers and stonemasons work in closely related trades creating attractive, durable surfaces and structures. The work varies in complexity, from laying a simple masonry walkway to installing an ornate exterior of a high-rise building. *Bricklayers*—also called brickmasons—build walls, floors, partitions, fireplaces, chimneys, and other structures with brick, precast masonry panels, concrete block, and other masonry materials. Additionally, bricklayers specialize in installing firebrick linings in industrial furnaces. *Stonemasons* build stone walls, as well as set stone exteriors and floors. They work with two types of stone—natural cut, such as marble, granite, and limestone, and artificial stone made from concrete, marble chips, or other masonry materials. Stonemasons usually work on nonresidential structures, such as houses of worship, hotels, and office buildings.

When building a structure, bricklayers begin by constructing a pyramid of bricks—called a lead—at each corner of a wall, around which the rest of the bricks are laid. Due to the precision needed, these corner leads are time consuming to erect and require the skills of experienced bricklayers. After the corner leads are complete, less experienced bricklayers fill in the wall between the corners, using a line from corner to corner to guide each *course*, or layer, of brick. Because of the expense associated with building corner leads, an increasing number of bricklayers use corner poles, also called masonry guides, that enable them to build an entire wall at the same time. They fasten the corner poles (posts) in a plumb position to define the wall line and stretch a line between them. This line serves as a guide for each course of brick. Bricklayers then spread a bed of mortar (a cement, sand, and water mixture) with a trowel (a flat, bladed metal tool with a handle), place the brick on the mortar bed, and then press and tap the brick into place. Depending on blueprint specifications, bricklayers either cut bricks with a hammer and chisel or saw them to fit around windows, doors, and other openings. Then, mortar joints are finished with jointing tools for a sealed, neat, uniform appearance. Although bricklayers usually use steel supports, or *lintels*, at window and door openings, they sometimes build brick arches instead , which support and enhance the beauty of the brickwork.

Hod carriers, or *helpers*, are workers who assist bricklayers. These workers mix mortar, set up and move scaffolding, and bring bricks and other materials to the bricklayers.

Stonemasons often work from a set of drawings, in which each stone has been numbered for identification. Helpers may locate and carry these prenumbered stones to the masons. A derrick operator using a hoist may be needed to lift large stone pieces into place.

When building a stone wall, masons set the first course of stones into a shallow bed of mortar. They then align the stones with wedges, plumblines, and levels, and adjust them into position with a hard rubber mallet. Masons continue to build the wall by alternating layers of mortar and courses of stone. As the work progresses, masons remove the wedges, fill the joints between stones, and use a pointed metal tool, called a tuck pointer, to smooth the mortar to an attractive finish. To hold large stones in place, stonemasons attach brackets to the stone and weld or bolt these brackets to anchors in the wall. Finally, masons wash the stone with a cleansing solution to remove stains and dry mortar.

When setting stone floors, which often consist of large and heavy pieces of stone, masons first use a trowel to spread a layer of damp mortar over the surface to be covered. Using crowbars and hard rubber mallets for aligning and leveling, they then set the stone in the mortar bed. To finish, workers fill the joints and wash the stone slabs.

Masons use a special hammer and chisel to cut stone. They cut stone along the grain to make various shapes and sizes, and valuable pieces often are cut with a saw that has a diamond blade. Some masons specialize in setting marble which, in many respects, is similar to setting large pieces of stone. Bricklayers and stonemasons also repair imperfections and cracks, and replace broken or missing masonry units in walls and floors.

Most nonresidential buildings are now built with prefabricated panels made of concrete block, brick veneer, stone, granite, marble, tile, or glass. In the past, bricklayers doing nonresidential interior work mostly built block partition walls and elevator shafts. Now, these workers must be more versatile and work with many materials. For example, bricklayers now install light-weight insulated panels used in new skyscraper construction.

Bricklayers use high-speed saws to cut bricks.

Refractory masons are bricklayers who specialize in installing firebrick and refractory tile in high-temperature boilers, furnaces, cupolas, ladles, and soaking pits in industrial establishments. Most of these bricklayers work in steel mills, where molten materials flow on refractory beds from furnaces to rolling machines.

Working Conditions

Bricklayers and stonemasons usually work outdoors. They stand, kneel, and bend for long periods and often have to lift heavy materials. Common hazards include injuries from tools and falls from scaffolds, but these can often be avoided when proper safety practices are followed.

Employment

Bricklayers and stonemasons held about 157,000 jobs in 1998. The vast majority were bricklayers. Workers in these crafts are employed primarily by building, special trade, or general contractors. Bricklayers and stonemasons work throughout the country but, like the general population, are concentrated in metropolitan areas.

Nearly 3 in 10 of all bricklayers and stonemasons were self-employed. Many of the self-employed specialize in contracting small jobs, such as patios, walkways, and fireplaces.

Training, Other Qualifications, and Advancement

Most bricklayers and stonemasons pick up their skills informally, observing and learning from experienced workers. Many others receive training in vocational education schools. However, the best way to learn these skills is through an apprenticeship program, which generally provides the most thorough training.

Individuals who learn the trade on the job usually start as helpers, laborers, or mason tenders. These workers carry materials, move scaffolds, and mix mortar. When the opportunity arises, they learn from experienced craft workers how to spread mortar, lay brick and block, or set stone. As they gain experience, they make the transition to full-fledged craft workers. The learning period on the job normally lasts longer than an apprenticeship program.

Apprenticeships for bricklayers and stonemasons are usually sponsored by local contractors or by local union-management committees. The apprenticeship program requires 3 years of on-the-job training, in addition to a minimum 144 hours of classroom instruction each year in subjects such as blueprint reading, mathematics, layout work, and sketching.

Apprentices often start by working with laborers, carrying materials, mixing mortar, and building scaffolds. This period generally lasts about a month and familiarizes the apprentice with job routines and materials. Next, they learn to lay, align, and join brick and block. Apprentices also learn to work with stone and concrete, which enables them to be certified to work with more than one masonry material.

Applicants for apprenticeships must be at least 17 years old and in good physical condition. A high school education is preferable; and courses in mathematics, mechanical drawing, and shop are helpful. The International Masonry Institute (IMI), a division of the International Union of Bricklayers and Allied Craftsmen, operates training centers in several large cities that help job seekers develop the skills needed to successfully complete the formal apprenticeship program. In addition, the IMI recently opened a national training and education center at Fort Ritchie, Maryland. The national center's programs teach stone, terrazzo, brick, tile, and refractory materials construction, as well as restoration work. Safety and foreman training also are part of the curriculum.

Bricklayers who work in nonresidential construction usually work for large contractors and receive well-rounded training—normally through apprenticeship in all phases of brick or stone work. Those who work in residential construction usually work primarily for small contractors and specialize in only one or two aspects of the job.

Often, experienced workers can advance to supervisory positions or become estimators. They also can open contracting businesses of their own.

Job Outlook

Job opportunities for skilled bricklayers and stonemasons are expected to be excellent, as the growth in job opportunities outpaces the supply of workers trained in this craft. Employment of bricklayers and stonemasons is expected to grow about as fast as the average for all occupations through the year 2008, and additional openings will result from the need to replace bricklayers and stonemasons who retire, transfer to other occupations, or leave the trades for other reasons. The pool of young workers, particularly those between the ages of 16 and 24, available to enter training programs will be increasing slowly; and many in that group are reluctant to seek training for jobs that may be strenuous and have uncomfortable working conditions.

Population and business growth will create a need for new houses, factories, schools, hospitals, offices, and other structures, increasing the demand for bricklayers and stonemasons. Also stimulating demand, will be the need to restore a growing stock of old masonry buildings, as well as the increasing use of brick for decorative work on building fronts and in lobbies and foyers. Brick exteriors should continue to be very popular, as the trend continues toward durable exterior materials requiring little maintenance. However, employment of bricklayers who specialize in refractory repair will decline, along with employment in other occupations in the primary metal industries.

Employment of bricklayers and stonemasons, like that of many other construction workers, is sensitive to changes in the economy. When the level of construction activity falls, workers in these trades can experience periods of unemployment.

Earnings

Median hourly earnings of bricklayers and stonemasons in 1998 were $16.92. The middle 50 percent earned between $12.85 and $21.52. The lowest 10 percent earned less than $9.77 and the highest 10 percent earned more than $27.63. Median hourly earnings in the industries employing the largest number of brickmasons in 1997 are shown below:

Nonresidential building construction	$18.20
Masonry, stonework, and plastering	16.70
Concrete work	14.20
Residential building construction	14.00

Earnings for workers in these trades can be reduced on occasion because poor weather and downturns in construction activity limit the time they can work.

In both of these trades, apprentices or helpers usually start at about 50 percent of the wage rate paid to experienced workers. Pay increases as apprentices gain experience and learn new skills.

Some bricklayers and stonemasons are members of the International Union of Bricklayers and Allied Craftsmen.

Related Occupations
Bricklayers and stonemasons combine a thorough knowledge of brick, concrete block, stone, and marble with manual skill to erect attractive, yet highly durable, structures. Workers in other occupations with similar skills include cement masons, concrete finishers, plasterers, terrazzo workers, and tilesetters.

Sources of Additional Information
For details about apprenticeships or other work opportunities in these trades, contact local bricklaying, stonemasonry, or marble-setting contractors; a local of the union listed above; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or the State apprenticeship agency.

For general information about the work of either bricklayers or stonemasons, contact:

☛ International Union of Bricklayers and Allied Craftsmen, International Masonry Institute Apprenticeship and Training, 815 15th St. NW., Suite 1001, Washington, DC 20005.

Information about the work of bricklayers also can be obtained from:

☛ Associated General Contractors of America, Inc., 1957 E St. NW., Washington, DC 20006.

☛ Brick Institute of America, 11490 Commerce Park Dr., Reston, VA 22091-1525.

☛ Home Builders Institute, National Association of Home Builders, 1201 15th St. NW., Washington, DC 20005.

☛ National Concrete Masonry Association, 2302 Horse Pen Rd., Herndon, VA 22071.

Carpenters

(O*NET 87102A, 87102B, 87102D, 87102F, 87105, and 87121)

Significant Points

- Nearly one-third of carpenters—the largest construction trade in 1998—were self-employed.
- Although employment is expected to grow slowly, job opportunities should be excellent because many carpenters leave the occupation each year.
- Many builders use specialty carpentry subcontractors who do one or two work activities, so versatile carpenters able to switch specialties should have the best opportunities for steady work.

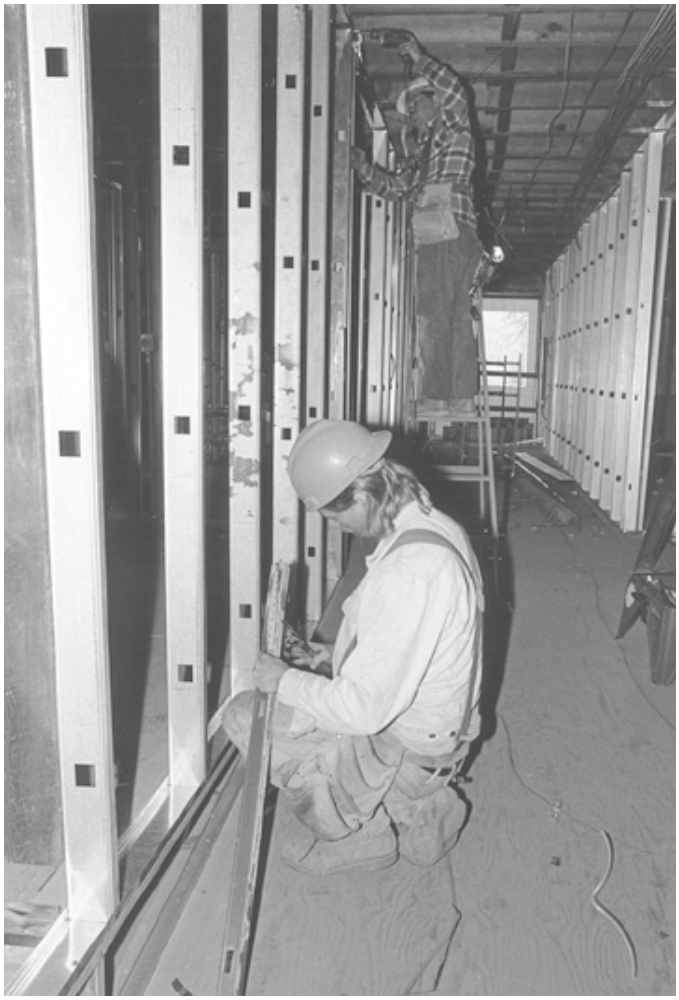
Nature of the Work
Carpenters are involved in many different kinds of construction activity. They cut, fit, and assemble wood and other materials in the construction of buildings, highways, bridges, docks, industrial plants, boats, and many other structures. Carpenters' duties vary by type of employer. Builders increasingly are using specialty trade contractors who, in turn, hire carpenters who specialize in just one or two activities. Some of these activities are setting forms for concrete construction; erecting scaffolding; or doing finishing work, such as installing interior and exterior trim. However, a carpenter directly employed by a general building contractor often must perform a variety of the tasks associated with new construction, such as framing walls and partitions, putting in doors and windows, building stairs, laying hardwood floors, and hanging kitchen cabinets.

Because local building codes often dictate where certain materials can be used, carpenters must know these requirements. Each carpentry task is somewhat different, but most involve the same basic steps. Working from blueprints or instructions from supervisors, carpenters first do the layout—measuring, marking, and arranging materials. They cut and shape wood, plastic, fiberglass, or drywall, using hand and power tools, such as chisels, planes, saws, drills, and sanders. They then join the materials with nails, screws, staples, or adhesives. In the final step, carpenters check the accuracy of their work with levels, rules, plumb bobs, and framing squares and make any necessary adjustments. When working with prefabricated components, such as stairs or wall panels, the carpenter's task is somewhat simpler than above, because it does not require as much layout work or the cutting and assembly of as many pieces. Prefabricated components are designed for easy and fast installation and generally can be installed in a single operation.

Carpenters who remodel homes and other structures must be able to do all aspects of a job—and not just one task. Thus, individuals with good basic overall training are at a distinct advantage, because they can switch from residential building to commercial construction or remodeling work, depending on which offers the best work opportunities.

Carpenters employed outside the construction industry perform a variety of installation and maintenance work. They may replace panes of glass, ceiling tiles, and doors, as well as repair desks, cabinets, and other furniture. Depending on the employer, carpenters install partitions, doors, and windows; change locks; and repair broken furniture. In manufacturing firms, carpenters may assist in moving or installing machinery. (For more information on workers who install machinery, see the sections on industrial machinery repairers and millwrights elsewhere in the *Handbook.*)

Working Conditions
As in other building trades, carpentry work is sometimes strenuous. Prolonged standing, climbing, bending, and kneeling are often necessary. Carpenters risk injury working with sharp or rough materials, using sharp tools and power equipment, and from slips or falls. Additionally, many carpenters work outdoors, which can be uncomfortable.



Some carpenters specialize in framing walls and partitions.